

NOTES & RECORDS — OF — THE ROYAL SOCIETY

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THE NOBEL LAUREATE SIR CHANDRASEKHARA VENKATA RAMAN FRS
AND HIS CONTACTS WITH THE BRITISH SCIENTIFIC COMMUNITY IN A
SOCIAL AND POLITICAL CONTEXT

by

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SUMMARY

The Indian Nobel laureate Sir Chandrasekhara Venkata Raman FRS (1888–1970) interacted closely with the British scientific community. He was elected a Fellow of The Royal Society in 1924, was knighted by the Colonial Government in 1929 and was awarded the Hughes Medal by The Royal Society in 1930. With the help of unpublished letters and newspaper clips, we show the influence of Raman's British physics professor on his life. Next we discuss how Raman came in contact with influential British men of science, who nominated him for the Fellowship of the Royal Society. Then we explore the ways in which he promoted Indian science by nominating his countrymen for Fellowship of the Society. Last, we describe how, in 1943–44, the Secretary of The Royal Society visited India to hold a historic meeting and for various reasons Raman did not take part in it.

Keywords: The Royal Society of London; Fellow of The Royal Society; Chandrasekhara Venkata Raman FRS; Archibald Vivian Hill FRS; Raman effect; Nobel prize.

INTRODUCTION

Chandrasekhara Venkata Raman influenced the development of physics in the twentieth century. In India, being so far the only Nobel laureate in the field of natural sciences, he remains a legendary figure. Several authors have discussed different aspects of his life.¹ The present article is a further addition to his life story and deals with his contact with the British scientific community. Here we discuss his scientific works that established him as a man of science and led to his nomination and election as a Fellow of The Royal Society. Next we explore how he obtained the help of his British colleagues to nominate Indian physicists for the Fellowship. We then show his reaction to, and possible causes for his protest against, the historic meeting of The Royal Society organized by its Secretary, Archibald V. Hill (1886–1977) in India.

THE EARLY PHASE OF C.V. RAMAN'S CONTACTS AND SCIENTIFIC WORK: RAMAN AND HIS BRITISH TEACHERS

Raman was born on 7 November 1888 in a village near Trichinopoly in the province of Tamil Nadhu. It seems that, from his childhood, he was interested in experimental work: as a middle-school student he himself built an electric dynamo and worked with a Leyden jar.²

Raman's lecture 'The scientific tradition: Professors Wilson and Jones', published by a newspaper on 2 February 1940, is clear-cut proof of Raman's views about his teachers. It starts with the statement 'Some of my pleasant recollections of the four years I spent at College in Madras are of the extraordinary kindness and consideration I received from the European members of the staff who were then the heads of the departments of study'.³ After giving a minor reference to his English Professor, Raman tells in detail about his chemistry and physics professors. As this part of Raman's life is either not given in detail or, if mentioned, is described without references,⁴ it is worth quoting some parts of Raman's lecture in detail. About his chemistry professor Dr W.H. Wilson, Raman had the following to say:

The most formidable figure at the College in those days—at least so he was considered by the vast majority of students—was Dr. W.H. Wilson. ... Actually he was—at least so it appeared to me—the member of the staff who took his duties most strenuously and did his work with that thoroughness which [is] traditionally associated with the Professors at the German Universities, at one of which he was reputed to have taken his degree. ... The lecture started at 2 p.m., and went on till he thought fit to stop. ... But on most days, his time was mostly taken up with experiments he had arranged and these were so good and so clearly explained that the lectures did not seem too lengthy. My own interest in them did not flag except when the list of chemical compounds he was explaining become a little too long.⁵

Raman had the following words about his physics teacher:

We had the Cambridge School of Physics represented by Professor R.L. Jones who was head of the Physics Department. Professor Jones was also Meteorologist in charge of the Madras Observatory. ... Professor Jones was regular with his lectures and took pains, now and again, to show us some lovely experiments which helped to impress on my mind the aesthetic beauty of scientific studies. Very early in my career at College, I had reason to be grateful to him for an act which made the study of Physics a pleasure instead of being a burden.⁶

It seems that Raman talked about his physics teacher often, as is evident from the statement given by his contemporary, the astrophysicist Meghnad Saha FRS (1893–1956), who in 1933 stated:

While as a student of the M.Sc. class at the Madras Presidency College, he carried out several improvements on Melde's experiments on the vibration of strings, and his originality of mind attracted the notice of Mr. Jones, the Professor of Physics, for whom Sir C.V. Raman cherishes the highest regard. Mr. Jones offered him a job in the educational department, but as during these times, all the higher posts in the educational service were exclusively reserved for Europeans, young Raman did not find the job sufficiently tempting, and instead of accepting it, went for the Finance Competitive Examination.⁷

Again in 1953, we find Raman's appreciation for Professor Jones, who was interested that his pupil should go to England for further studies. About this the Nobel laureate Raman, while addressing young students, recalled that Professor Jones sent him to Colonel Gifford (presumably Sir Gerald Giffard) for a physical check-up and 'Gifford

examined me and certified that I was going to die of Tuberculosis ... if I were to go to England'.⁸ Obviously, Jones had an everlasting impression on Raman.

In the Presidency College Raman and his colleague, while performing the standard Melde's experiment on the vibration of strings, observed a strange effect.⁹ On this matter the young student Raman wrote on 10 May 1906 a letter (reproduced in part in the section '*Raman in Madras*'¹⁰) to the author of *Theory of sound*, who was no less than the Nobel laureate John William, 3rd Baron Rayleigh Strutt FRS (1842–1919), who responded on 15 July 1906. What we see here is a young and self-conscious Raman. In later years the *News Chronicle*, dated 7 November 1948, gave rather an exaggerated version of the story as follows: 'While studying at the Presidency College he interested himself in Rayleigh theory of sound. Lord Rayleigh hearing about it, wrote and congratulated the young pupil at the Presidency on his method of performing Melde's experiments on the vibration of strings.'

In 1907, after successful examinations, Raman was appointed as a bank officer in Calcutta. There he came in contact with the Indian Association for the Cultivation of Sciences (established in 1876 by an Indian doctor, Mahendra Lal Sircar), which offered him a laboratory for research. Until his appointment as a professor at the University of Calcutta in 1917, Raman did research in his spare time.

During his college days Raman had observed that when monochromatic light falls obliquely on a rectangular aperture at angles greater than 87° the diffraction bands are not equidistant from the middle band, the bandwidth increases progressively from one side of the pattern to the other, and the number of bands on one side of the pattern is limited. He derived a mathematical equation to explain his observations.¹¹ Later the phenomenon was studied in detail by visual, photographic and photometric measurements.^{12–15}

Another phenomenon studied by Raman and his students were the colour of mixed plates or films consisting of transparent media. Earlier work on this topic was that of Charles Fabry (France) and Robert W. Wood (USA), who tried to explain the colour of the mixed plates from the standpoint of diffraction theory. Raman noticed that some observed features differed from what one might expect from the usual elementary theory of diffraction phenomena. One such example was the diffraction halo seen surrounding a distant light source viewed through a mixed plate of uniform thickness. Existing theory was unable to explain the succession of dark and bright rings of rapidly increasing width from the centre outwards, the perfect blackness of the dark rings in the outer part of the halo, and the composite structure of the inner part of the halo. Raman was of the opinion that 'the whole surface of the film does not appear luminous, but only the laminar boundaries or lines of separation of the two media forming the film'. The optical effects were therefore due to the scattering or radiation of light from laminar diffracting boundaries.¹⁶ Raman's school suggested that the number of rings depends on the thickness of the film and its composition.¹⁷ They derived equations for the position of the bright and dark rings. In later papers the effect was studied theoretically and experimentally for white and monochromatic light for uniform and non-uniform films, and for normal and oblique incident light.¹⁸ They showed that their theory was quantitatively in accord with the experiment.

From 1921 onwards he diverted his attention to the phenomenon of the molecular diffraction of light. After successfully explaining the blue colour of the sea, he decided to test the existing theories of light, namely whether light has a wave or a quantum structure—an issue that in those days was a point of controversy.¹⁹ These investigations led to the discovery of the Raman effect (the change in wavelength of monochromatic light after being scattered through a transparent medium) and consequently the Nobel prize for Raman ‘for his work on light scattering and the discovery of the effect named after him’.

Until the end of 1921 (the year of his nomination for the Fellowship of The Royal Society) the number of his publications on optics and acoustics (musical instruments) had reached 60.²⁰ In the first decade he started with simple problems of acoustics such as the motion of nodes in a vibrating string. It was known that nodes of a vibrating string could not be at rest, because the energy is transmitted through these points to maintain the vibration.²¹ Raman studied the motion of nodes stroboscopically under periodic illumination, with a magnifying glass²² and photographically,²³ and showed that the motion at the nodes can differ in phase by a quarter of an oscillation from that of the rest of the string.²⁴

In 1918 Raman’s first major monograph related to musical instruments entitled ‘On the mechanical theory of the vibrations of bowed strings and of musical instruments of the violin family, with experimental verification of the results, part 1’ was published.²⁵ In it Raman declared,

The present position of the subject cannot be considered satisfactory, in view of the fact that no complete and detailed dynamical theory has been put forward which could predict and elucidate the many complicated phenomena that have already been found empirically by those who have worked in the field and that could also point the way for further research.

In the monograph Raman provided a theory for the motion of a bow and described different types of vibrations that come into play owing to the interaction of string and bow, and the effect of variation in the pressure and velocity of the bow on the string. He also gave an experimental verification of his theory. Further, he studied (theoretically and experimentally) the minimum bow pressure required to produce a tone in a violin.²⁶ Raman’s work on the violin, done in the second decade of the twentieth century, still finds its mention.²⁷

Rather less well known is the fact that Raman tried his hand in the field of astronomy. Because his activities in the Astronomical Society of India (founded in 1910 in connection with the observation of Halley’s comet²⁸) and scientific work in this field are explored in a separate paper,²⁹ we omit this aspect here and in the following section concentrate on his contacts with the members of the Astronomical Society.

RAMAN AND HIS NOMINATORS

Raman, being a member the Astronomical Society of India and later holding various positions such as Secretary of Business, Honorary Secretary and the Director of the Variable Star Section, had the chance to meet W.J. Simmons (President of the Astronomical Society), Sidney G. Burrard FRS (1860–1943), John Evershed FRS

(1864–1956; a Vice-President of the Astronomical Society³⁰ as well as the Director of the Kodaikanal Observatory in India), and Gilbert T. Walker FRS (1868–1958; the Director-General of Observatories). Some of these well-known persons later nominated Raman for election to the Fellowship of The Royal Society.

Before proceeding further it is worth mentioning that according to the statutes of The Royal Society, only the Fellows of the Society had the right to nominate a candidate,³¹ and the nomination certificate should be signed by at least six Fellows,³² who from their personal knowledge of the candidate's contributions to the natural sciences recommended the candidature.

Raman's nomination certificate shows that he was proposed by G.T. Walker and seconded by George C. Simpson (1878–1965), of the Indian Meteorological Department.³³ They also communicated some of Raman's papers.^{34,35} In those days, because the scientific community in India was too small, Raman must have had contact with Charles S. Middlemiss FRS (1859–1945), who worked at the Geological Survey of India. Middlemiss was also a member of the well-known Asiatic Society of Bengal, Calcutta (established by William Jones FRS, in 1784), and in 1917 was President of the Geological Section of the Indian Science Congress³⁶ (founded in 1914 by two British chemistry professors working in India).

In 1921, for the first time in his life Raman went to England to represent the University of Calcutta on the occasion of the Universities Congress at Oxford. There he met, among others, the great atomic physicist Ernest Rutherford FRS (1871–1937), who made an everlasting impression on Raman. For instance, in 1938, giving tribute to Lord Rutherford at Loyola College Raman stated that Lord Rutherford became a kind of guru for him: he was an imperialist but he was also an internationalist. In the field of science, he made no distinction between Britishers and persons belonging to other nationalities.³⁷

It was also during this visit that Raman met another nominator, Alfred W. Porter FRS (1863–1939). Raman spent some days in Porter's laboratory and worked together with G.A. Sutherland. His host communicated their paper for publication in the *Proceedings of The Royal Society of London*.³⁸ Another nominator, Edwin H. Barton FRS (1858–1925), was a known authority in the field of acoustics. He knew Raman's experimental investigation on the maintenance of vibrations referred to in his textbook of sound in 1914,³⁹ and abstracted many of Raman's papers.⁴⁰

Walker, Simpson, Middlemiss, Porter, Burrard, Barton and Evershed signed Raman's nomination certificate. Raman was proposed in November 1921 and elected on 15 May 1924. His election as FRS improved his status not only in India but also in the British scientific community. Shortly after the election he received an invitation from the British Association for the Advancement of Science to attend its session in Canada. The British Association granted a substantial amount for his travelling expense.⁴¹ The Government of India recognized his work and 'started in 1926 to give an annual donation of Rupees 10,000/- which was increased to Rupees 20,000/- per annum in 1927'.⁴²

Now, according to the statutes of The Royal Society, being a FRS, Raman had the right either to support a proposal or himself nominate candidates for the Fellowship.

RAMAN AND HIS CANDIDATES FOR THE FELLOWSHIP OF THE ROYAL SOCIETY

Birbal Sahni

Birbal Sahni FRS (1891–1949), an Indian palaeobotanist, was elected in 1936; his nomination certificate shows that Raman supported his candidature.

Kariamanikkam S. Krishnan

Raman's own first personal nomination was that of Professor Kariamanikkam S. Krishnan (1898–1961), who in 1948 was to become the founder director of the National Physical Laboratory, Delhi, and also contributed to the nuclear energy programme. Raman sent the 'statement of qualifications of Professor K.S. Krishnan, D.Sc., Mahendra Lal Sircar Research Professor of Physics at the Indian Association for the Cultivation of Science, Calcutta' to The Royal Society. It contained Raman's comments about Krishnan's work and a list of his publications. The document shows that, up to the end of 1932, Krishnan had published 38 papers, whereas, since the beginning of 1933 (that is, after his appointment as Professor at the Indian Association for the Cultivation of Science (IACS), Calcutta), the number of his publications had increased to 62; there were 22 additional papers by his students. At that time Krishnan had established himself as an authority on magnetic anisotropy in crystals. In his nomination certificate Raman, as Krishnan's proposer, wrote about him as follows:

Distinguished for his investigations on molecular optics and on magno-crystallic action; collaborated with Sir CV Raman in extensive-theoretical and experimental studies on light scattering, molecular optics and in the discovery of the Raman effect (1928). More recently, has published many valuable investigations ... on the significance of magnetic anisotropy in relation to crystal architecture and thermo-magnetic behaviour at the lowest temperatures. Has published important work on pleochroism in crystals and its relation to photo-dissociation. Leader of an active school of research at Calcutta.

After satisfying himself that Krishnan was the right candidate, Raman started with the second part of the nomination, namely to find supporters. For this purpose he wrote to the physicist Owen W. Richardson (1879–1959) on 16 November 1935:

I am enclosing herewith for your kind perusal a brief statement of the work of Professor K.S. Krishnan I have been considering the desirability of proposing his name for election to the Royal Society, having felt for sometime that his work was sufficiently meritorious to justify his name being put. As a preliminary I am writing to ascertain whether you could kindly agree to be one of the signatories to a certificate on his behalf from general knowledge....

The Krishnan–Raman correspondence shows that similar letters were written to the British Fellows Frederick G. Donnan, Lewis L. Fermor, R. Robertson and Alfred E.H. Tutton.⁴³ These Fellows signed Krishnan's nomination certificate.

After nomination, the work was not finished. To increase the chances of election, Raman wrote a letter on 19 January 1936 advising Krishnan that

It is now up to you to support your candidature by discreet propaganda and also by fresh scientific efforts. I would suggest that you send me immediately a complete set of your publications, which I shall forward to the Secretary for consideration by the Committee. You might also send some of your more recent papers to the Members of the Physics Committee and of the Council of the Royal Society....

As a result of the efforts of nominee and nominators, on 14 March 1940 Krishnan was elected an FRS.

Homi J. Bhabha

After this successful selection, in the same year Raman proposed a second candidate, Homi J. Bhabha (1909–66), who was still a young lecturer at the Indian Institute of Sciences, Bangalore, but in the independent India was to play a major role and would become recognized as the father of the Indian nuclear energy programme.

Bhabha, a theoretical physicist, is known for his achievements in the field of particle physics. Regarding Bhabha's nomination on 20 July 1940, Raman communicated with the renowned theoretical physicist Paul A.M. Dirac FRS (1902–84) and sent him Bhabha's scientific record for his opinion and to find out whether he (Dirac) would agree to support his candidature. After getting Dirac's consent on 25 October 1940, Raman sent Bhabha's certificate to the Dirac, asking him to sign it as seconder as well as to obtain support from two other Fellows. In the same letter he informed Dirac that Max Born FRS (1882–1970) and Marcus L.E. Oliphant FRS (1901–2000) had agreed to support Bhabha's election. In India, Raman asked Krishnan to sign Bhabha's certificate and forwarded it to B. Sahni for further processing.⁴⁴

Bhabha, proposed by Raman and seconded by Dirac, was elected in March 1941.

Subrahmanyan Chandrasekhar

Raman proposed as his next candidate the astrophysicist Subrahmanyan Chandrasekhar (1910–95),⁴⁵ who later brought the Nobel prize to the USA, because he pursued his research in England and the USA.

With the increasing number of Indian Fellows, Raman was able to obtain their support. For Chandrasekhar's candidature he prepared the certificate and got it signed by Sahni and Bhabha.⁴⁶ He wrote a letter to the renowned astrophysicist Edward A. Milne FRS (1896–1950) at Oxford.⁴⁷ The nomination certificate reveals that the latter not only seconded Chandrasekhar's certificate but also obtained support from eminent astrophysicists and Fellows James H. Jeans (1877–1946) and Arthur S. Eddington (1882–1944). According to Chandrasekhar's nominated certificate, he was nominated in October 1941 and was elected in March 1944.

The above three cases clearly show that British experimental physicists, theoretical physicists and astrophysicists saw Raman as an integrated part of their community and supported him. Integration means not only a smooth-going life, but also disputes. In the 1940s Raman was involved in a scientific controversy with the British crystallographer Kathleen Lonsdale FRS (1903–71) on the question of priority and the interpretation of diffuse spots in X-ray Laue photographs, and later in connection with the different types of diamond.^{48,49} Because this part of the story has been explored in a separate article, we omit the details.⁵⁰ However, to follow the future discussion, we give some aspects of his contacts with Indian men of science.

RAMAN'S CONFLICT WITHIN THE INDIAN SCIENTIFIC COMMUNITY

To show that Raman was a quarrelsome and dominant personality, we here briefly discuss three points.

The issue of the IACS

The Advance of 15 December 1932 published a letter from Raman's former co-worker C.M. Sognai, a professor at the Benares Hindu University. In the letter Sognai listed 20 Bengali scholars who worked under Raman and were in good positions in various departments. Thus he refuted the views of an anonymous writer who, on 4 December 1932, had written that during Raman's time the Bengali students had derived little from the IACS. Clearly, in Calcutta a group of people started propaganda against Raman. At this stage the relation between Raman and a particular group of Bengalis was not cordial.

In 1933 Raman accepted the directorship of the Indian Institute of Science, Bangalore. Because he still was the President of the IACS, it gave impression that he wanted to control the Association. After a hot discussion in a meeting Raman resigned his presidency of the Association.⁵¹ At nearly the same time another issue became a point of discussion between Raman and a 'Calcutta group', as described below.

Formation of Indian academies

In January 1930 men of science in India assembled in Allahabad to discuss establishing a science academy.⁵² As an experimental measure the United Provinces Academy of Sciences was founded,⁵³ and Saha was the main driving force behind this step. As the experiment was a success, the Council of the Academy suggested that the Academy's name be changed to the Indian Academy of Sciences (IAS)⁵⁴ or that a new body be formed.⁵⁵ In its November 1933 issue the editor of *Nature* pointed out that 'difficulties are likely to arise in deciding upon the most suitable centre for the new organisation'.⁵⁶ Lewis L. Fermor (1880–1954), a British chemist and metallurgist working in the Geological Survey of India, took an active part in preparing the Academy's constitution and was empowered to put the views of Calcutta group, which was of the opinion that Calcutta was the best place for the Academy because it was historically a scientific centre, had many scientists and had existing international relations. In January 1934, on the occasion of the Indian Science Congress (ISC) in Poona, Calcutta's claim was advanced by Fermor. On 3 January 1934 an Academy Committee was commissioned to prepare a report.⁵⁷ The first meeting was held in Calcutta on 11 and 12 February 1934.⁵⁸ It seems that matters did not go according to Raman's expectations, because before the next meeting Raman and his colleague Subha Rao resigned from the Academy Committee. Raman justified his step as follows:

One of the reasons on which I object strongly to this little group at Calcutta is that they are prejudicing the most fundamental and vital issue. ... We should not seek for an academy of the exclusive type and concentrate power in the hands of a few. We ought to have an organisation in which every part of India will be represented. We do not stand for unconstitutional methods. ... I do not wish to be a member of an Academy brought out in haste and I refuse to nominate myself to this Academy.⁵⁹

By making an application on 27 April 1934, Raman registered the IAS.⁶⁰ From the newspapers of 30 April 1934, Indian men of science came to know of Raman's action.⁶¹ All this led to criticism of Raman.

To find a compromise between these different groups a new name for the planned academy was suggested as the National Institute of Sciences (NIS, today known as the Indian National Science Academy). Fermor, who was the President of the Academy Committee, also became the first President of the NIS.

Indian Institute of Sciences

For various reasons Raman came into conflict with his Indian colleagues, who were either members of the Council of the Institute, or professors or students. The only British person involved in this dispute was K. Aston, a professor in the Electrical Engineering Department at the Indian Institute of Sciences, Bangalore. Raman was asked by the Council to resign his directorship. Seeing no other way, Raman sought the help of the eminent and influential physicist Lord Rutherford. It is well known that Rutherford interfered and saved Raman's professorship, although Raman could not remain a director.⁶²

In 1937 Raman considered leaving India. One of Raman's letters to Sir Owen Richardson FRS (1879–1959) shows that Raman applied for a chair in Cambridge, but without success.⁶³ Similarly he did not get the Pieter Zeeman Chair in Amsterdam, as some of the members of the local committee wanted to have a Dutch incumbent or a young physicist.⁶⁴

In the following section we reflect on how these points help us to understand Raman.

THE HISTORICAL MEETING OF THE ROYAL SOCIETY OF LONDON IN INDIA, AND RAMAN'S ROLE

Raman had the ability to choose good researchers, take care of them and later help them to find good positions. By 1938 there were about 80 persons who worked under or with him, occupying important positions in universities, colleges and government departments.⁶⁵ This trend continued in the independent India.⁶⁶ In Calcutta he was the editor of the *Indian Journal of Physics* (established by him). In Bangalore, almost overnight, he founded the IAS (remaining its unchallenged president until his death in 1970) and its *Proceedings* were edited by him. He was also one of the founder members of the Bangalore-based journal *Current Science*.

By 1941 there was a discussion among British scientists that Indian men of science should be supported for their work and ought to be involved in war efforts.⁶⁷ However, representatives of the Government of India did not show any interest.⁶⁸ It was only in 1943 that The Royal Society was asked by the Secretary of State for India to send a representative who would give advice on the organization of scientific research.⁶⁹ In this connection Archibald V. Hill FRS⁷⁰ (1886–1977), a Secretary of The Royal Society, was informed about the 'possible fields for extra-mural work in connection with the armed forces in India' such as signals and electrical equipment, wireless communication and airborne forces.⁷¹ On 16 November 1943 Hill arrived in India.⁷² Three days later he wrote

a letter and asked for information from the heads of enquiries on scientific research resources in India in the fields of engineering, chemistry, biology and health research.⁷³

A.V. Hill, who was a Vice-President of The Royal Society under its President Henry H. Dale FRS (1875–1968), forwarded Hill's letters to Sahni, Raman, Bhabha and the chemist Shanti S. Bhatnagar FRS (1895–1955).⁷⁴ On 18 November 1943 Hill wrote to Sahni as follows:

... The Council of the Royal Society asked me to do a thing which will be unique in the history of the Society, and to act on behalf of the President in admitting four Fellows (Bhatnagar, Bhabha, Krishnan and Sahni) of the Society who have never yet been able to present themselves at a meeting of the Society in London for their admissions.

In one of Dale's letters it was written that the ceremony of signing the parchment (by Bhabha, Bhatnagar, Krishnan and Sahni) on the occasion of the ISC session would be preferred.⁷⁵ Another letter of Dale's, written on 29 October 1943, was directed to the President of the National Academy of Sciences, Allahabad. In part it reads:

I am asking Professor Hill to transmit, through you, the cordial greetings and friendly sentiments of the Fellows of the Royal Society of London to the Members of the National Academy of Sciences. We have the confident hope that one of the results of Professor Hill's visit will be to strengthen the bonds of understanding and true comradeship between our Indian colleagues and the men of science of this country.

As we have seen above, the Indian scientific community was already split by the existence of different academies. Dale's letter was addressed to the National Academy at Allahabad and not to the Indian Academy of Sciences, Bangalore. This was obviously not acceptable to Raman.

Raman consulted Bhabha and Krishnan; together they formulated a letter in which they appreciated Dale's offer of cooperation between British and Indian scientists. They were wary of losing the opportunity to sign the Charter Book in the historic room of the Society in Burlington House;⁷⁶ their objection was also:

We ... feel that if a function of the kind proposed, which clearly affects only the Fellows of the Royal Society, is held for the purpose of obtaining our signatures in India, then it should be entirely unconnected with the meeting of any other society or organisation in India.⁷⁷

Raman, who was not at all affected, supported 'his candidates' by writing an extra sentence: 'I entirely agree with and support the views expressed above'.⁷⁸ In a separate letter dated 3 December 1943 he asked Sahni that if he agreed to the content of the accompanying letter he should sign it in the first position, being the senior FRS. Raman also informed Sahni that, besides himself, Bhabha and Krishnan were not going to attend the ISC.

Sahni hesitated to sign the joint letter, because according to his interpretation of Dale's letter his [Sahni's] right of signing The Royal Society's Charter Book would not be cancelled.⁷⁹ However, there was no time for further discussion. Sahni informed Hill about the joint letter and their decision not to attend the ISC.⁸⁰ Naturally, Hill was not happy with it and was of the opinion that the ceremony of signing the parchment should take place before the inauguration of the meeting.⁸¹ It seems that the reason for preferring this occasion was that the ISC was a general body of Indian scientists open to university and college teachers as well as research institutions, and was therefore a better platform to

demonstrate recognition by The Royal Society in front of the participants, and to motivate those present for war efforts and postwar programmes.

In the 281-year history of The Royal Society it was the first meeting to take place outside England.⁸² Hill inaugurated the historical meeting in Delhi.⁸³ He read out letters from Richard A. Gregory FRS (1864–1952; President of the British Association for the Advancement of Science), from Field Marshal Smut and from the Prime Minister Winston Churchill FRS⁸⁴ (1874–1965). Their general message was to praise India's scientists and to propose scientific collaboration for the advancement of science.

Hill's lecture shows that only Bhabha⁸⁵ and Bhatnagar were present to sign the parchment.⁸⁶

Hill's work during his stay in India was a difficult mission.⁸⁷ Sometimes he was suspected of industrial espionage. For example, during his visit to Madras University, Hill had to defend himself by stating that he 'had been invited by the Government of India and had not been sent by the British industrialists to "steal the secrets of Indian industrialists" as somebody had remarked'.⁸⁸ He also found it difficult to bring the sundered Indian scientists together. *The Hindustan Times* of 4 February 1944 reported that Hill was convinced that Indian scientists would rise above their temporary differences and contribute substantially to the new world. On 6 April 1944 he left India.⁸⁹ He had ensured cooperation between two countries. To put it into practice, the Government of India decided to send a delegation of Indian scientists in May 1944.⁹⁰ *The Hindustan Times* of 6 April 1944 shows that S.S. Bhatnagar (Director of the Scientific and Industrial Research Institute), M.N. Saha FRS (Professor of Physics at the University of Calcutta), S.K. Mitra (Chairman, Radio Research Committee of the Board of Scientific and Industrial Research and Secretary of the Indian Science Congress Association), Sir Jnan C. Ghosh (Head of the Indian Institute of Sciences, Bangalore, and President of the National Institute of Sciences of India) and three more persons were sent.

Raman's omission was a matter of concern in India, and was interpreted as a nationalistic action, which fitted the political situation of those days. A local periodical, *The Blitz*, reported on 28 October 1944:

An Indian Scientists Mission without Sir C.V.? A Hamlet without the Prince of Denmark! No, the clue perhaps lay elsewhere; Sir C.V. Raman is not merely a scientist, dead to all life around. He is also a patriot. Under Prof. Hill's auspices, in a mission sponsored by the Government of India, will they be touring at own will? Will they be touring at their free discretion? Is there a free Government behind them? Sir C.V. Raman is a great scientist, but not a good salesman for British wares.

One of Raman's letters shows that a similar delegation had to visit England in 1946. Raman, who had previously accepted the invitation of the Government of India to take part in the Empire Scientific Conference, later refused to join because he was not ready to accept the National Institute of Sciences as a leading body, as he wrote to Akbar Hydari, member-in-charge of the Department of Planning and Development (Delhi).⁹¹ He pointed out that his action should not be understood as disrespect to the Government and, further, that he was 'most anxious that my action should not be misunderstood by that society which had treated me with great consideration during the past years'.⁹² He requested Hydari to forward a copy of this letter and also about his withdrawal from the delegation to The Royal Society.

There seems to be even a deeper reason for Raman's protests, namely his views about the relation between a scientific institute and politics. Raman disliked the interference of politics in scientific affairs. This point is illustrated with three examples from three different time periods.

The Leader dated 2 December 1931 gives some early glimpses of this issue. While addressing convocations at the alumni of the Agra and Allahabad universities Raman mentioned that the universities should be freed from the baneful effects of political intrusion. 'The day when universities are run not by your teachers but by your politicians will be the day when India will slip down on the road and become a fifth class power like Rumania and Bulgaria. She will not then be able to rise [to] the height of Great Britain and Germany'.

The second case is directly related to The Royal Society. In the late 1940s Raman felt that political elements were predominating in The Royal Society, as is evident from the following statement:

we need not to look at the Royal Society for guidance. The Royal Society today, in spite of its distinguished past, was unfortunately tending to become more a political than a purely scientific body. Some of the officials of the Royal Society seemed to be more interested in maintaining British connections with India than to any purely scientific research. The mixture of politics and science ... was not likely to prove a success and it was not well that Indian had taken a step, which would enable her to take an independent line in the international scientific field.⁹³

Even in independent India he displayed his way of thinking again. For instance, after 1948 he 'hardly ever attended the Indian Science Congress..., on the ground that they are inaugurated by politicians. ... The politician who invariably inaugurated the yearly Congress from 1949 until his death in 1964 was Jawaharlal Nehru'.⁹⁴ According to the author G.H. Keswani,

He [Raman] refused to participate in the making of science policy in India. He did not accept an invitation to serve on the Board of Scientific and Industrial Research of the Government of India; nor did he accept an invitation earlier of the National Planning Committee of the Indian National Congress, which had Nehru as its Chairman in 1938–40.⁹⁵

In 1948, in Paris after celebrating the 20th anniversary of the Raman effect, he visited England. *The Indian Express* of 8 May 1948 mentioned Raman's lecture, 'The fascinating story of the diamond', given at the University of London on 28 April 1948. During this visit Richard A. Gregory FRS related the following story about Raman⁹⁶ as a press reporter stated:

... many years ago, when he [Gregory] was editor of *Nature*, he received a letter from the Professor referring to certain spectroscopic lines and putting forward what seemed to be an impossible theory. So incredible was Professor Raman's discovery, that before feeling prepared to publish it in *Nature* ... he consulted Professor R.W. Wood of Baltimore who happened to be in London at the time. After reading Professor Raman's letter, Professor Wood declared, 'I don't believe it!' Three weeks after the letter appeared in *Nature*, Professor Wood visited Sir Richard and said, 'Raman is right'.⁹⁷

Raman, who did not agree with developments in India, distanced himself from state policies but continued his own activities at the IAS and the Raman Research Institute, and maintained his contacts. In 1949 he founded his institute, which was financed by donations from the public in India and the Government of Mysore, and sponsorship in the amount of Rp. 300 000 was given by the IAS.⁹⁸

In 1949, on 16 September, Raman wrote to John D. Bernal FRS (1901–71), of Birkbeck College Research Laboratory, London, and asked him to attend the Fifteenth Annual Meeting of the IAS, which was to be held in Bombay. Bernal, who had received an invitation from the Indian Science Congress, which had its meeting in January 1950,⁹⁹ gave his decision at the end of November.¹⁰⁰ On 10 December 1949 Raman sent a provisional programme, showing that there were other important speakers such as Madame Joliot-Curie (Paris), Jean Frederic Joliot-Curie (Paris), O.E.H. Rydbeck (Götheburg) and Hermann Mark (Brooklyn).¹⁰¹ Bernal gave a talk on ‘X-rays in organic chemistry’.¹⁰² The *Times of India, Bombay* of 31 December 1949 reported the presence of Sir Robert Robinson (1886–1975), Nobel laureate and the President of The Royal Society, and Edward U. Condon, Director of the National Bureau of Standards, Washington; they were introduced to the audience by Raman.

In the following years some of the British Fellows who visited Raman were Charles G. Darwin, Paul A.M. Dirac, Edward C. Bullard and Cecil F. Powell.¹⁰³ Raman had a long disagreement with Max Born FRS on the theory of lattice dynamics.¹⁰⁴ He came into conflict with Darwin and R.E. Peierls FRS (1907–95), who did not agree with Raman’s ideas and rather supported Born’s. Raman believed that British physicists were influenced strongly by Max Born.¹⁰⁵ Obviously Raman’s relations with the British men of science were ambivalent. Raman was associated with the Society for a long period, about 44 years, and resigned from the Fellowship in March 1968. Although Raman was no longer a member, after his death due tribute was paid to him in *Biographical Memoirs of Fellows of The Royal Society*.¹⁰⁶

CONCLUSION

Raman owed much to his British teachers and had a high regard for them.

In the second phase of his life, Raman’s contacts with British scientists working in India began during his activities in the Astronomical Society of India. The nomination of Raman for the Fellowship by some of the British Fellows from India shows how the integration of Indian men of science started. This led to firm contacts between two scientific communities, and certainly influenced the development of the natural sciences in India.

With the support of British Fellows he nominated the Indian physicists K.S. Krishnan, H.J. Bhabha and Subrahmanyam Chandrasekhar. This shows not only Raman’s good relations but also how a Fellow might interact with a colleague before proposal as a candidate.

Election as a Fellow means the recognition of a person as well as a country in the world scientific community; obviously Raman helped to bring Indian science onto the world scene. With these steps Raman contributed to the development of Indian physics. He was aware of this aspect. For instance on 17 November 1931, in a press interview he emphasized: ‘National awakening has got other fields than politics in which it can show itself. ... I think scientific endeavour has certainly a national value, and I have heard it said that what Indian scientists, particularly physicists have done, had helped more to raise the estimation of India in the world than recent political events’.¹⁰⁷

Here we also see another aspect of Raman's life: he disliked the interference of politicians in academic affairs. He saw scientific activities as an isolated entity. Very often in his speeches (not referred to here) he criticized politicians for misusing science.

Raman and Krishnan's first paper on the discovery of the Raman effect appeared in *Nature* because of the farsightedness of the editor, Richard A. Gregory, notwithstanding the failure of the expert, R.W. Wood, to judge the importance of the discovery.

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